Two-Lane Highway Operations Under a Lane Closure

Author: Donald Watson, University of Florida

Background

- In a previous study by Washburn, Hiles, & Heaslip (2008), a new procedure was developed to analyze traffic operations on two-lane highways with a lane closure.
- The new procedure accommodates many more input variables and provides more reliable results.
- The procedure was developed using results obtained from FlagSim, a microscopic simulation program for two-lane highways operating under flagging control.
- The scope and resources of the project did not allow field data to be collected to calibrate and validate the FlagSim program.
- The FlagSim results used to develop the procedure may differ from what is observed in the field.

Objectives

- Improve the previously developed procedure by collecting field data to calibrate and validate the FlagSim program.
- Collect data from 2 rural sites and 1 urban site in Florida.
- Run the simulation experiments previously performed by Washburn, Hiles, & Heaslip (2008) using the calibrated FlagSim program.
- Update the analysis procedure using the results obtained from the simulation experiments.

Data Collection and Analysis

- Video data was collected at 3 lane closure sites (2 rural and 1 urban).
- At each site, approximately 4 hours of data was collected each day for 4 weekdays.
- Cameras were placed at each end of the lane closure to record traffic and flagging operations.
- An instrumented vehicle was used to collect additional video of trips through the lane closure.
- Values for FlagSim inputs, such as flows and start-up lost time, were obtained from the data.
- Values for measures output from FlagSim, such as average “green” time, queue length, and work zone travel time, were obtained from the data.
- Data was aggregated into approximately one hour time periods to account for variations in flow and other inputs required to calibrate FlagSim.

Calibration and Validation

- Simulation runs were performed for each time period using inputs obtained from the data.
- Outputs from the runs were compared to values obtained from the field.
- FlagSim underestimated the “green” times and travel times observed in the field when calibrating to the first site.
- Video from the instrumented vehicle showed that construction vehicles (e.g., dump trucks) slowed down in the work zone, which decreased traffic flow through the lane closure.
- Modifications were made to the program to improve agreement between the simulated and field results.
- Initial calibration of FlagSim to the first lane closure site is complete.
- Calibration of FlagSim to the second site and validation with the third site will begin shortly.

Results

- After modifying the FlagSim program, simulation runs were performed for the first study site.
- Results for one day of data are shown below in Table 1.

<table>
<thead>
<tr>
<th>Period #</th>
<th>Period Length (min)</th>
<th>Traffic Direction</th>
<th>Data Obtained</th>
<th>Work Zone Entry Volume (veh/h)</th>
<th>Average Time in Work Zone (sec/veh)</th>
<th>Average Queue Size (veh/phase)</th>
<th>Average Greens Phase (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59.55</td>
<td>Peak</td>
<td>Field</td>
<td>72.94</td>
<td>185.83</td>
<td>5.13</td>
<td>197.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field</td>
<td>FlagSim</td>
<td>46.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>Field</td>
<td>70.93</td>
<td>187.96</td>
<td>5.43</td>
<td>187.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>FlagSim</td>
<td>67.70</td>
<td>206.72</td>
<td>3.89</td>
<td>206.72</td>
</tr>
<tr>
<td>2</td>
<td>58.18</td>
<td>Peak</td>
<td>Field</td>
<td>88.69</td>
<td>159.76</td>
<td>10.43</td>
<td>159.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field</td>
<td>FlagSim</td>
<td>81.99</td>
<td>242.90</td>
<td>5.88</td>
<td>242.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>Field</td>
<td>38.70</td>
<td>97.48</td>
<td>0.00</td>
<td>97.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>FlagSim</td>
<td>38.70</td>
<td>167.43</td>
<td>2.04</td>
<td>167.43</td>
</tr>
<tr>
<td>3</td>
<td>59.52</td>
<td>Peak</td>
<td>Field</td>
<td>78.63</td>
<td>138.96</td>
<td>10.00</td>
<td>138.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field</td>
<td>FlagSim</td>
<td>78.63</td>
<td>158.97</td>
<td>4.61</td>
<td>158.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>Field</td>
<td>68.49</td>
<td>290.34</td>
<td>9.50</td>
<td>290.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>FlagSim</td>
<td>64.50</td>
<td>185.97</td>
<td>2.54</td>
<td>185.97</td>
</tr>
<tr>
<td>4</td>
<td>75.75</td>
<td>Peak</td>
<td>Field</td>
<td>78.30</td>
<td>191.38</td>
<td>5.85</td>
<td>191.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>Field</td>
<td>78.30</td>
<td>162.63</td>
<td>3.28</td>
<td>162.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Peak</td>
<td>FlagSim</td>
<td>67.40</td>
<td>196.69</td>
<td>3.23</td>
<td>196.69</td>
</tr>
</tbody>
</table>

Conclusions

- “Green” times, travel times, and queue lengths were closer to what is observed in the field.
- Some measures are still underestimated when compared to field results.
- May need to look into different methods to account for construction vehicles’ impact on traffic.
- Additional calibration and validation should be performed using data from the second and third field sites.

Research to be Completed

- Calibrate the FlagSim program to the second field site.
- Validate FlagSim using data from the third field site.
- Run the simulation experiments previously performed by Washburn, Hiles, & Heaslip (2008).
- Update the analysis procedure using the results obtained from the simulation experiments.

References